7.

1952 doc. 478

UNITED STATES
DEPARTMENT OF THE INTERIOR

DI-6

APPROVED DECEMBER 19[illegible]

K.M. Waage

NOTEBOOK — 7.

CONTENTS

1952

A.P. notes — Willow Cr. to Rainbow Cr. (B.O.V. 35-65) — 1.
[willow Cr. section starts p.2]

★ Helmer mine section and sampling — — — — — 5.

Weaver Gulch - partial section of Dakota — — — 7.

★ Rainbow Creek section (BOV-35-65 ⑤) — — — — — 9.

Robinson strippings - Turkey Cr. — — — — — 13.

A. P. Notes - Willow Cr to Fault (BOU-35-65 (cont) 35-67) — — 14.
2nd Resumé of clays Helmer mine - fault.

A-P Notes - Alameda N to Rt. 40 (AIN-50-19, 50-17) — — 19.

Dakota - Morrison Field Conference #1 — — — — — — 28.

Thesis revelent to Dak problem? Uof Col — — — — 29.

A-P Notes AIN-50-17 — — — — — — — — 30.

★ 6553 Bellvue section — — — — — — — — — 32

★ 6553 Little Thompson section — — — — — — — 40

Lyons road section #1 (AIM-1B-163) — — — 47

" " " #2 — — — 48

Little Thompson area notes — — — — — 50

Lyons road section #3 — — — — — — 51

AIN-51-28 (includes section clays S of Ralston Res.) — — — — — — — — 53

Notes on theses at Colo. Univ. — — — — 57

AIN-50-44 (to 46) — — — — — — — 59

AIN-51-28 — — — — — — — — — 60

AIN-50 44 (cont) — — — — — — — — 62

AIN-51-25 (small) — — — — — — — — 63

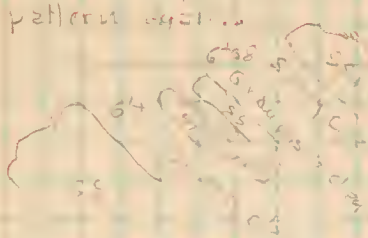
AIN-50-41 — — — — — — — — — 64

★ Hogback mine section — — — — — — — — 65

★ Streinland mine ~~cut~~ section — — — — — — — 67

A.P. notes:
Willow Creek to Rainbow Creek (B.O.U. 35-65)

(1) Clay beds at top of Lake 2. Lacustrine pattern with ...



(2)

clay beds at this locality should be sampled or otherwise explored.

3. Outcrops and rock [illegible] are poor on the little clays but not [illegible] exposures. Dark clay seams [illegible] prospecting. Lacustrine silts [illegible] not exposed.

4. [illegible] very close to top [illegible] very few platy beds. [illegible] lithologic like [illegible] stringers [illegible] accessible [illegible]

Section [illegible] this spot. [illegible]

[Willow Creek section]

1
1
1
75.0

A. 75.0 Covered to base of [illegible] outcrops downward [illegible] clayey [illegible] coarse [illegible] downward. Upper 50' are gray [illegible] red [illegible]. Base of this [illegible] cycles. Then 10 ft [illegible] massive [illegible]

2.

A (cont.)		A base is 2 to 6 inch fe stained ligh zone.
B	6.3	S[illegible], very fine ss, platy to irreg. bedded, even-bedded, rel. few shely ptngs
C	3.0	As above & grad. with it, but somewhat more shely.
D	10.0	S[illegible], fine grained, [illegible] rusty brn fe stained [illegible] tortuous [illegible]
	16.0	Sandy [illegible] grading down into [illegible] silt(?) [illegible] platy [illegible] silt.
F	2.0	Shely [illegible] with silty laminae and a few beds ±1" of silt.
G.	15.—	Siltstone [illegible]
H	1.6	Shely nodul gray silty-silty s'y. 1" bed of silty bentonitic [illegible] base.

11.5 Siltstone, gray mottled, argill. massive in upper part becoming platy & shaly in lower

46.0 Sandstone, fine to med, tabular (cross bedded) x-lam., becomes coarse in lower 5'
Basal 2.4 is chert pebble cgl. with many white clay stone frags.

Disconformity?

[illegible]

[illegible]

talus covered slope.

11.1
16.
24
12.7
63.8

Helmer Mine section and sampling.

Entering Helmer Mine (N 7 W, 51°)

6.3 Massive cross-bedded ss. [illegible]
, medium grained, friable [illegible]
[illegible] top.

9.3 Clay [illegible] [illegible]
silty ocd. [illegible]

5.6 Fine grained ss [illegible]
up to 4' thick, partings of [illegible]

6.7 Clay red. [illegible]
1.0 Light gray clay & silty clay (Sample 1)
1. Silty [illegible]
with [illegible]
2. Dk gray clay [illegible] (Sample 3).
3. [illegible]
Bottom of Clay

Pebble [illegible]
Upper [illegible]

for [illegible] Helmer mine section. [illegible]

1.2	[illegible]
3.6	[illegible]
1.7	IB [illegible]
	[illegible]
0.1	[illegible]
---	[illegible]

Notes on Helmer section.

Total absence of any Dakota clay is noteworthy - SS. is much thicker than would appear at surface because it is friable, points to fallacy of assuming Dakota clay present.

Main source of clay [illegible] above main bed. Its character in the area, from Helmer gap south, is distinctive and not like ~~similar~~ correlative clays to north.

Weaver Gulch, section of upper beds in old road cut. cap. N 21 W, 35 ±

(15)

USSU
North Weaver Gulch
#1

	.6	O
	.2	O
	6.5	O
	.5	O
	1.2	O
	.2	O
	.7	O
	1.4	O
	6.2	O
	6.0	O
2	3.5	O *

*

J	6.2	Sandstone, medium-grained, [illegible]
K	1.6?	Sandstone — fine-grained, [illegible]
L	1.5	Sandstone — fine-grained, [illegible]

Note 7.5' [illegible] base J. At [illegible] of SS K, [illegible] base [illegible]

7

Weaver Gulch, section of upper beds in old road
cut, N. side gap. N 21 W, 35 E
AIN 49-08 (15)

A 10.0 [illegible] [illegible] pt, [illegible]
[illegible] S, [illegible]
[illegible] partings. (pro[illegible]
[illegible])
B 0.6 Sand[illegible], massive bed [illegible]
C 0.2 Shaly sandstone, [illegible]
D 6.5 [illegible] chert
fine [illegible] upper [illegible]
chert pebbl[illegible] ss.
[illegible] 0.5 Silty [illegible], thin platy [illegible]
and thin beds.
[illegible] 1.2 Sand[illegible] D.
[illegible] 0.2 [illegible]
[illegible] 0.7 Sand[illegible] loose [illegible]
chert pebbl[illegible]

I 1.4 Shale, [illegible]
with thin [illegible]
J 6.2 S[illegible] [illegible]
[illegible]
[illegible]
K 1.6? Sandstone — [illegible] but
[illegible]
[illegible] of slumping [illegible]
[illegible]

Take K = 6 as basal ss of USSU

(Note 7.5' [illegible] zone from base J. At [illegible]
of S. K., ~~[illegible]~~ basal 1.5 ft of this is L
L 1.5 Gr[illegible] ss [illegible] with .5 shaly
siltstone [illegible] base.
[illegible]

M. 5.0 Wash covered 30-ft, over a s[illegible]
or [illegible] silt stn.

N 0.1 Flaky to bony-clay-like layer.

O 21.0± Wash cover [illegible]
[illegible]
[illegible]
[illegible]
Top [illegible]

[illegible]

B.O.V. 35-65 Rainbow Creek section. (Pieced at N side

5. gap from continuous exposures,

From top down

A	——	Shale and silty shale grading within 10' ± to typical Graneros. some platy siltst. in lower foot
B	5.5* ±	Siltstone ledge, white weath. ± 0.8 at top. Then interbedded silty shale, siltstone and fine sandstone obscured by wash. Lower 1.5 is gray silty shale.
C	2.1	Ledge cross-bedded x low fineness, silty white weath at top.
D	2.7	Sandstone, massive, x-bd, friable, orange brn-weath.
E	2.5*	Shaly siltst + silty sh. obscured.
F	2.7*	Sandstone as in D. becoming silty in lower part — up slope this unit thickens to ± 4'
G	3.5*	Shale zones obscured by wash
H	3.3*	Interbedded platy siltstone + fine ss in beds up to .5, partings silty sh.
I	6.0*	Sandstone, ~~tr~~ fine-gr. ledge ~~platy~~ to irreg. bedded, lite gr. some Fe stain on weathering picks grades into H above.
J	6.3	Clay zone — chiefly argill siltstn. gray, minor silt, clay in pockets lower 2 shaly siltstn.

* Approx. thickness ... ledge.

9.

27
29
21.5
77

1.5
5.6
4.1
26.6
38.2

20.3

55
71

K.	38.2	Sandstone, upper 1' ± platy with fair well preserved dicot remains. [This most diversified flora found to date] Then fine to med. gr. tabular X-bdd, with some clay pellet zones.
		Separate unit as see * below. Intraform cgl + interbed clst + siltstn v basal 2' [member] Fish Creek [tongue]
L.	6.7*	Shale, hard dk gray silty, with laminae + interbeds siltstn.
M.	19.3	Sandstone, fine to med gr. weath, lite gr. brown even to irreg bed x lam.
N.	77.5	Sandstone, ~~fine~~ med + coarse locally cglitic, chiefly massive X-bedded, lower 20' riverbed locally p.gl + yellow weathg. clay pellet cgls common chert pebble cgl: 21.5 ft from base and in basal foot ±, some stringers in other parts.
Uncon.		
O.	10.3	Sandstone and siltstone, ledge, thin bedd - irreg. bedded, to platy, upper 1' ± to irreg, low 1' shaly and more like "platy beds" -
P.	53.0	Top seamless to top 3rd. 2nd ss makes up about 30' of this, contains silty gradation beds at base. Remainder obscured by weath. ledge weak ss some siltst.

Split obscured 2 covered

Formations applied to:

* No evidence that this is main bed. Ib ss + clstn bz of K. contains flora levels + bed reported S.

6.5
48.6
35.1

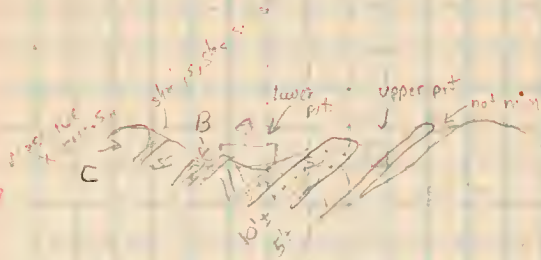
Q	53.0	Sandstone, massive, [illegible] V. l/sm. ss., fine-gr. except at base which is med. to coarse gr. w/ l.-w. Lower 12' massive x-bed. coarse to med., basal 1'± is cgl. (see Spec.
break lower		
Disconformity		
R.	15.3	Argillaceous siltstone to silt. massive. weath. lite gray & white with pink sandstone base capped with .8 ferruginous, ochre siltstn.
S.	4.1	sandstone, massive bed x/sm fine gr. weaths light yellow-gray
T.	24.0	Obscured by slope wash, contains silty, irregular claystone, wash of red & white clasts. Red zone in upper 5'. From 4 to 10 ft above base ss. like Q, similar to that in S.
U.	48.0	Sandstone, massive crossbedded, brick red weathering, med to coarse cgl throughout (chert pebbles) In upper 2' mottled purple red zone, also similar coloring in more or less fine gr. ss basal 4. This ss grades into purple argillitic, hard, silty, argillite. Base of cgl beds on rel flat Fe stained surface top this 4' fine-bed

On top 3rd cap N. 32W, 47°

V. 48.0 Wash covered slope on sh. salt, sum. silty, sandy. Appears at base is concentration of percellanite (specimen) See also piece of queer stuff

Notes U. - this unit contains 4' fine gr to argill ss at base that is not part of cgl above, but rests disconformably - or unconformably under it. The varicolored lower 4' could be interp. as a Morrison bed and the unconf. as contact with Lytle. At this locality no cgl. bed in slope below horizon U - but doesn't mean there isn't one.

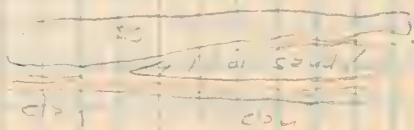
Kansas Bri... ...ing on Turkey Cr.



A. Sandstone = 0.7
Clay, s.s. pinches out, thickens 4.1
siltstone increases to 4' ± at expense
clay.

B. IP sandstone, shaly, lenticular, ss., platy.

C. Siltbearing ss, massive x-bed., cons
in as distinct channel



AiP notes Willow Cr. to fault, (BOV 35-65 [cont] and 35-67. Also resume clays of area

6. See below 7 this page

7. Old stone quarry in ss above main clay bed. The double Deltote clay exposed here, beds silty not as thick as to south (±4'). Section can be had here from base ss above main bed (see 6.) to Cretaceous transition. Sandstone, while rel. thick, does not exclude upper clay beds as at Helmer mine. The bed over main bed is cut out here. [This bed is one furnishing most clay at Helmer mine.]

6. Outcrop of ripple-marked sandstone and bentonite-like clay at base of main bed. The ss over this clay lies unconformably about 18 inches above this. Therefore between (2) and this locality the sandstone thickens appreciably, cutting out the riders and part of main bed. This condition appears to persist to faulted end of hogback on Indian Creek altho it cannot be proven that clay exposed in position of main bed is actually the main bed as it lacks the basal bentonite, chances are it is the lower split of main bed.

8. Evidence of red + white clay here between 3rd ss + Lytle. Somewhere between Willow Creek section and

8(cont.) this locality the variegated claystone with sandstone layers comes in. It lenses out again by Indian Cr. where 3rd ss sits directly on Lytle ss

B.O.V-35-67
①

Indian Creek gap shows about same section as on Rainbow Cr., with thin clay bed, prob. lower split main, in between 2 easternmost ss ridges. 3rd ss sits directly on Lytle ss. Fault cuts of all but Lytle south of Creek. No details of fault-zone mapped. See Scott's map.

Resume' - Helmer Mine to cut-off Fault on Indian Cr.
Clay:- In this segment the clays in the Helmer mine [Main bed and thicker one immediately above] are intermittently exposed as far south as deep cleft cut by S. tributary of Willow Cr. in SW¼ sec. 19. T. 7 S., R. 68 W. Between this point [①+② of BOV-35-65] and the Helmer mine more clay beds come in at position of 3 small beds over main bed, (also lower split main bed comes in.) Exposure on S. trib. of Willow Cr. is maximum development of this clay-bearing zone in this segment— and as far as known for entire stretch S. of Robinsons Hogback Mine.

Between this locality and the Stone quarry ½ mile to south [B.O.V. 35-65 ⑥⑦], all but basal foot ± of main bed and lower split have been channeled and ss above has thickened appreciably [from about 6' with clay split at loc. ②, to about ~~between~~ 35' at quarry. Thickness latter can be checked on map.]

Clay above upper ss also in at loc. ① B.o.V. 35-65, and looks fairly good & minable thickness. It is out completely at Helmer mine. To south it is thinner and more silty at Stone quarry; it is intermittently exposed south of here and probably continuous till cut ~~off~~ by fault north of Indian Creek.

The S. branch Willow Creek locality is best exposure of unprospected clay seen in entire hogback S. of Golden. Area not now accessible by road, but trail in from Rockboro Pk rd on Willow Creek Ranch passes along it on pediment surface. Access road from Helmer mine would be easy. Worth trenching as Dakota clay, main bed and its riders, as well as lower split are all in here.

Stratig: Area characterized by thickness and prominence of sandstones. "Dak", first Glen, 3rd and massive Lytle cgls all local ridge formers. Lytle cgl. locally contains much quartzite and agatized wood, commonly deeply red-stained where variegated (chiefly red clasts) zone present below discont. Local coarser areas but generally cgl continuous from Helmer mine S without break, altho local thin var. clay stone lenses common. At Rainbow Cr. section appears to be definite unconf. betw. cgl. & 4' varicolored fine gr. argill. ss bed below — latter could be Morrison. W of Helmer mine note another thin ledge cgl. below main bed.

Between 1st & 3rd ss the section varies, with base 1st very nearly meeting 2nd in some places (See Willow Cr. section). Platy beds become less platy southward but retain thin-irreg bedded character and lie between 2 well-defined breaks the cgltc base 1st Glen ss and flat discont. at top 2nd ss. Latter feature made prominent throout hogback by fe ~~zone~~ cap,

1st Glen. ss. is more variable in this area, has frizable ss at base, x bedded, cgltic - very much like typical Lytle and even has pink-purple cast locally (Rainbow Cr.). Mzq = carb. ss & silts of Morrison & Turkey Cr. sections as there is sharp uncomf contact between it and the main body 1st Glen ss above. Locally a cgl bed just above this uncomf on Rainbow Cr.

Next ss ledge (above main clay zone) has good looking plants on upper surface at base of lowest clay bed in upper clay zone. Layer with leaves crusts first hogback ledge (going E to W) Leaves are dicots of much greater variety than those found in main clay and lenses in 1st ss. This doubtless environmental as plants of willow-like aspect in main clay & 1st ss also found in 'Dakota' clay at Deer Cr, and latter clay is strat. above the horizon in question. This locality on Rainbow Cr is only good, varied dicot flora found by us so far.

Dakota clays silty, interbedded with ss not impressive - See Rainbow Cr. Section.

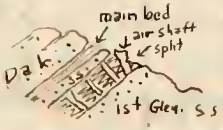
Alameda - Rt. 40 Hogback.

AIN-50-19

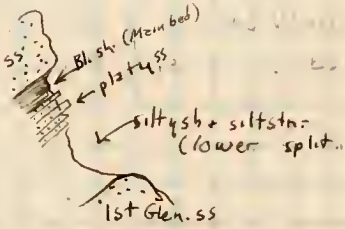
(1)

(2)

(12)



(3) (3)

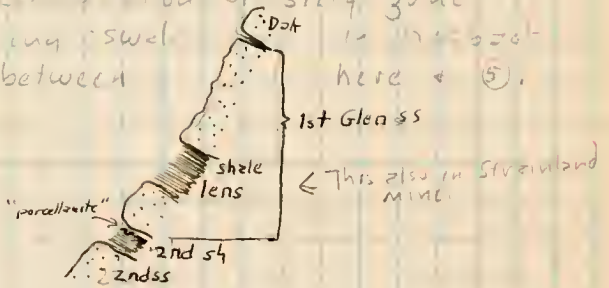


(4)

orang. ern. weath, whereas 1st Glen. is thick tabular x bm.

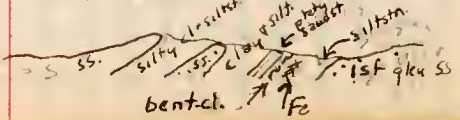
(5) Datum 1st Glen contact swings back over here - but no evidence of clay or break.

(6) Lens of bleached silty shale comes into the 1st Glen ss here - near base. It is [illegible] of silty zone forming swell in [illegible] top between here & (5).



(8) back [illegible] prior main bed reappears [illegible] once here. Is 35 ft - 4 ft, thin in upper part, silty lenses [illegible], under it 1.7 platy thin [illegible] to 1st Glen.

(7) N. 10. W, 29° E.
Main bed in swale with slump bedding. Clay not [illegible], only little 3 in over it.

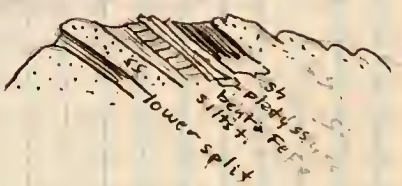


over

(7) cont. Rough (Type) slanting, up from top 1st Glen

6.7± – Sandst – probably lower split.
2.+ – SS. fine gr, x lam.
4.5 – Siltstone, shly, .5 bent clay at top, silty, with local Fe concretionary bands at t.
2.5± – Platy SS.
3.2 – ~~clay~~ Shaly, silty base
3.0 SS. fine-med, clay pebble cgl in base
7.0 silt stone, platy & silty sh. [illegible] x lam. SS.

Old (10) Main bed back at crest, & well exposed Band zone ± 1.0 thick and [illegible] Fe concretions.

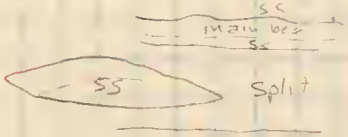


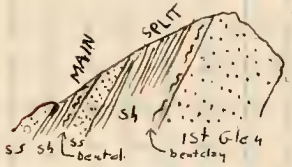
(8)

(9.) Detroit clay is cut out thruout most of wooded area — here channelling in Ozk ss considerable 2nd ss thickens appreciably.

AIN-50-17

(1) Knob of fine gr ss plant frags comes in as small channel facies in lower split of main bed. Lower split thick- clay bearing on flat ridge to N.





(2.) [illegible] thickens appreciably here - in steps to N. [illegible] has with bentonite under it. (Cf [illegible].) This is where main

bed goes out to south + stays out
except for three sandstones, the S.
Pete area?

(3.)

Most of bed covered, can't be
seen [illegible], [illegible] but
transitional beds?

8.0 ± Covered, [illegible]

8 [illegible]

2.5 Clayey shale with [illegible]

9.6 [illegible] thin sandstone beds obscured

I.3 Clayey fine-grained sandstone with
0.2 zone clay with beds of clay
top. In upper 0.2 zone [illegible]
0.6? Silty shale to [illegible]
base; [illegible]
= Rabbit

11.4 Sandstone, tan to gray, [illegible]

0.4 Argill[illegible]

8.7 Sandstone, tan, clayey, [illegible]
thin shale [illegible] lower 1' shaly

1.4 Sandstone, silty, shaly [illegible]
in lower 0.6

4.1 Sandstone, massive, fine-grained

0.4 Shaly siltstone + silty sh

3.0. Sandstone, fine-grained, massive to
even bedded, platy fissile
clayey beds

[illegible]

(4)

3.3

4.8

(sample #1)

7.4

Sample #2 (clay only)

1.8

4.2

1.1

25

Resumé - Alameda N. to lat. Denver ~~fired~~ Sewer pipe mine.

Clay:- Main bed is not present at minable thickness until ± 100 ft south of old stope hole wsw Denver Sewer Pipe mine. (AIN 50-17 ②). It is present, as shown between here & Alameda, where overlying ss not in channels thru it. Opens up at swale AIN-50-19 ⑦ to about 3', this thickest between points mentioned. Most exposures can be identified by basal bentonitic clay which thickens southward and at swale just mentioned (and vicinity) contains concretionary Fe within it.

Split. - Bed below main bed present at those places main bed is except at S end near highway. At AIN 50-17 ① old pit in it - very silty, then at N end pit, on N. side of wedge-like lense ss forming local ledge, split thickens greatly, forming broad flat belt at crest hogback. Extent of this lens clay shown on photo by dashed green line. At N. end line it begins to silt-up and ~~rapidly~~ grades into siltstone ½ way along old stope hole in main bed in slope below.

Dakota - in bench as shown - not exposed

Stratig. SS in Dakota thins at N where main clay comes in. 1st Glen.

sand is well exposed most of way N to where main clay is ± minable. It is thick thruout most this area, typically tabular x-lam and with local silty lenses and, in one place a shale lense. Where main bed in W of Denver Sewerpipe mine the ss is noticeably thinner and not cliff forming. Need measurements to prove rate thinning but it looks abrupt.

May be some correlation between thinning of 1st Glen. and thick main clay in this area.

Second clay has top bent. clay, unit is thin thruout area in question.

So-called platy beds not prominent & consist chiefly of ss in thicker beds than typical platy. No fossils. Zone locally Fe. Stained.

Dakota – Morrison Field Conference #1, July 30.

With Mudge, Vanhorn, Scott + McDowell.
Visited Boxelder, Bellvue, Spring Canyon, Carter Lake, Lyons, Fourmile Creek, Eldorado Springs, and Plainview section.

General agreement that so-called Dakota beds below disconformity more closely related to Morrison in genesis, that disconf. mappable contact. Also that Lytle beds, in spite of variation from place to place can probably be mapped as a unit. Unit could be ① member of Morrison ② separate formation, Lower K?

Base of Lytle –

Boxelder – Mudge would put it base massive white ss and not include red clsts + white ss between it and green shale

Bellvue – All agree on base massive cgl ss.

Spring Canyon – " " " " " "

Carter Lake – " " " " " "

Eldorado Spgs – " " " " " "

At all but last locality no red or maroon beds beneath cgl.

Plainview – Van Horn – base 1st massive ss
Mudge self – base 2nd (calc) ss

All inclined to agree that cgl bed west end not is Morrison.

GS-G1
1:1130
9/11/44

Colo Spgs
GS-ET series

Thomas - has worked Dakota in Wyo. & Colo.

Zena M. Hunter, 1947: Geologic patterns in the foothills of the Front Range, Colorado. Phd Thesis

Nothing on Dak of note

Nothing.

Baker, Vernon, 1949: Geology of the foothills between Masonville and Bellvue Colo. MS.

Local nothing new, no sections, map missing

Culligan, Leland B. 1948
Geology of the Loveland fold Area, Loveland, Colo. MS.

No Good

Heaton, Ross L. 1916
Geology of the South Boulder, District

See notes p. 57

Dorrell, Carrier Victor, 1939
The use of mechanical analysis in the correlation of Cretaceous Beds near Northern Colo.

Week - no good data.

Murray, Albert 1924
Some Antewarp & Retreat Clays of Colorado

Geol section Dak outcrops and thickness of sh.

Quam, Louis O 1932
Geology of Rabbit Mt Area, Colorado.

Nothing

Stagner, Howard R. 1933
Geology of Carter Lake Area, Colorado.

Nothing

Wagner, Eugene J. 1934
Geology of the Lyons Area, Colorado.

Ok on structure betw. Golden & Boulder tho may be wet locally.

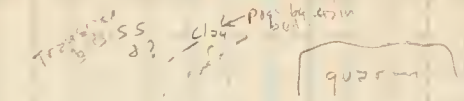
Butler, Charles Edgar 1920
Structures of the pre-Cambrian formations in the vicinity of Coal Creek, Colorado

See notes p. 58

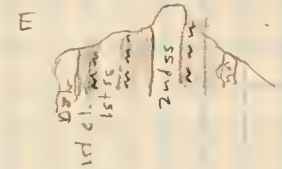
Hayes, John 1920
Correlation of the Cretaceous Sediments in Denver Basin, Colorado
wrong title see p. 58

AIN-50-17

(5) Datota crops here in fault slice. N5°W 45°W on ss. Fault on W indicated by [illegible] ground in th shrinkage cracks + ss + silt-fine N 26° W on "fault". May be off on this.



(6) At this point 3rd ss thins out into slope and 2nd ss becomes crest-former — unusually resistant for 2nd ss here. On E slope beds ⊥ at depth — creep at surface pulls them over.



May be fair chance for a section here.

(7) Cgl. ss lenses. [illegible]

(8) Lytle here is almost devoid of ss, most exposures in pit show mostly white cloth and red cloth thin ss.

Topog - Davis or Cummings

Bellvue section

From base - up.

Gray to green-gray silty clays'ones of Morrison.

A	4.0	Stained surf. top of Morrison gray clstns.
UNCONF.		Mottled purple, o-br. clstn silty
B	7.0	Interbedded fine to coarse gr ss and beds intrform cl. cgl. with sm. cht + qtst pebbles. Basal 2' is friable cht peb
? UNCONF.		cgl. + coarse ss with clstn matrix.
C.	56.0	- Sandstone massive, vequely x-lam, fine to coarse, lowerist' coarsening-up to cgl ss, local cgl. stringers above this. Weaths. yellow brown with pinkish cast — pink esp. ir. noticeable in fine cgl. Basal cgl this unit av. ½ diam peb. + is coarser than cgl's in B above.

This unit varies laterally, pockets sandy variety clstn betwn channel sands rare in this coop but impress. plant stems + fossil wood at some channel contacts in disturbed zone.

Spec-1 cgl from base C

Spec-2 wood from betw. channelss in C.

D.	2.0	Interbedded fine-gr sandstone, and variegated claystone, green-gray, pink, greenish.
E.	6.0	Claystone, and argill siltstone to fine argill. SS. - locally silty, predominates with interbeds silty clay. Lt gray to pink
F.	16.0	Claystone, silty clay and argillaceous siltstone, red-purple, green, yellow and gray white.

LOCAL COLOR ARRANGEMENT

SS. (colors as at top of unit)

- gray white with bright O-br stains
- yellowish gr [10YR 6/6 to 7/1]
- red-purple [5R-4/2 – 5/2 to 5RP-4/2]

- Local green silty clay
- gray-white to bright green-gray [5G 8/1 for freshness – grades to gray white]

SS. rich at E.

At top in gray zone with orange-brown large concretionary? mass (1'diam) chert (Spec. 31), protruded 3 inch or so above contact into overlying SS. Smaller qtz & pyrite nods. Smail within 1' of contact. Clay has gyp throughout in fractures.

* Disconf.

G.	0.3 to 4.0	Variable unit. In most places is similar to sandstone ledges in I, but locally

thins as black clstn above thickens, becomes friably soft and carbonaceous.

H. 3.6. Black to carb. clstn, minor sh at top, ~~sandy~~ very silty, and dk gr. argill. siltstone. Loc. dk gray to gray, carb fossils and 3" zone pink gray top.

I. 3.7 Sandstone, massive, fine grained, ledge. Weaths brn - red brn. Hard dense most places but shales out locally as does G. Where this happens K rests on dk shales with sandy zones & disjointed. ~~massive~~ by olv 5b on light.

J. 1.2 Two .4 beds gray to dk gray sh. with .4 ledge ss (as in I) between. The ss thickens locally to as much as 2.0 and shales remain only as partings between. I, ~~this~~ ss & K.

K. 5.4 Sandstone ledge, massive fine gr, dense, hard, ~~and~~ brn weath. Contains zone shot with tubes and this is locally agglutinated tubes at all angles.

L 3.1 Shale zone. Upper 1' an argill. siltstn with plant frags, dk gr. then in mid 1'+ of fissile bl. sh. becoming Fe mottled yellow & siltier

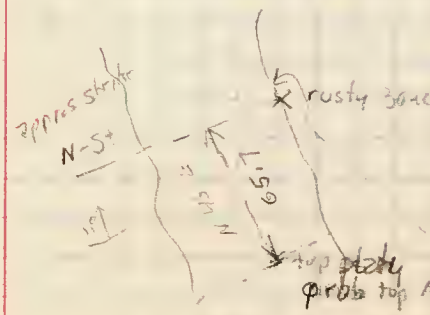
38
22
157
50
657

downward, basal 1' sh. & silty sh mottled yellow, Fe stain.

M.	5.9.	Interbedded thin, platy ss lenses 1/8" to 4.0 thick and dk gr shale with laminae & thin beds silt. sandstone siltstone locally argillaceous, bedding surfaces full of trail & burrow type markings. Some vertical borings.
N.	14.2	Sandstone, locally, evenly bedded thinly laminated brn, weath. fine grained sandstone. upper few inches shaly or platey laminated ss.
	N 15° E 12° E	
O	1.2	Shale, olive, weathered, obscured.
P.	1.5	Shaly ~~c~~ laminated locally platey ss. greenish cast

Beds above this obscured. Approx measurement of distance across strike (⊥) from top of N to first recog. zone in shales above

134'



Dip 15° E

Q	12.5	Interval obscured. Thickness approx. consists of dk gry sl shaly, fissile clay in upper 10' ± below this silty beds locally present but section obscured.
R.	7.6	Dk gray silty cl. shale with scattered silty laminae & thin beds. [Sample 1]. 0 to 0.3 siltstone bed at top obscure.
S	6.6	Dk gr silty cl. shale, lower 4.0 with thin laminae & beds silt, upper 2.6 less silty [Sample 2]
T	0.1	Bentonite
U.	6.8	Shale & silty sh dk gr., lower 1ft silty zone, upper 3' sh black clayey little silt. 0.1 to 0.3 Bed white weathered argill silt at top. [Sample 3]
V	3.2	Dk gr to bl clay shale, (Sample 4) - worth test?
W.	10.7	Highly silty shale, loc. argill, shaly silt. with interbeds and laminae of siltstone 0.6 silty bed at top [Sample 5]
X.	8.8	Shale, blocky dk gray silty, mottled, [Sample 6] gypsum
Y	4.7	As above - gyp in cross fractures [Sample 7]
Z	4.5	Shale, more fissile than X

Caribou

		Dk gray with few thin silt beds. [Sample 8]	
AA.	0.3	Bentonite	
BB.	2.5	Dk gray shale grading to olive weath. silty shale	Sample 9.
CC	2.2	Interbedded silty shale and olive br. weath. thin beds siltst + fine ss. Local calc. conc. in this zone.	
DD.	7.4.	Dk gray shale, somewhat silty loc., gypsite. (Sample 10.)	
EE	8.3	Interbedded dk gray fissile gyp. shale, calc. siltstone + fine ss and, in upper 2'±, beds xln (petrolif.) ls. w Fossils in lower 3' to 4' ls.	
ABIZ		Trace here Bellvue coal of 1951 canic. (Sample 11 = shale)	
FF.	4.0	Gray clay shale, finely silty	S 12
GG	0.1	Bentonite	
HH	4.7	Gray clay shale, finely silty with ~~thin~~ some silt laminae.	
II.	3.7	Interbedded silty gr sh and platy siltstone; weak calc reaction.	S 13
JJ.	1.1	Bentonitic clay	
KK.	2.6	Shale, dk gr. silty with thin silt laminae.	

LL.	0.4	Bentonite (up to 1.0 locally)
MM	2.5	Shale as in KK.
NN	30.0	Interbedded calc. silt + fine ss, sandy ls and silty sh with laminae silt. ls. is fossiliferous. (A-811)

[Sample 14 is mid and lower 15' of NN.]

Above NN wash obscures section to Dakota SS, may even be fault between NN & Dak?

2.1
.5
4.2
5.2
15.6

11.2
7.1
15.6
1.6
3.8
14.0
53.3

Little Thompson section.

Starting base of slope in draw at top of Massive ledge 3rd SS.
N. 9° W, 16° E on platy beds in A.
N. 6° W, 16½° E on bedding plan in 3rd ss.

Top. Massive to even bed x lam. ss brn weath of 3rd

A.	11.2	Partially obscured, ledges of platy grey fine grained sandstone with interbeds, irreg. bed of argill ss and siltstone, and shaly silty & silty shale, grey. Carb. particles throughout.
B.	7.1±	Obscured— Grey silty shale and siltstone, wash covered. Siltstn in layers up to 2", bed siltstone (Fe-stn.) at top.
C	15.6±	Shale, hard, grn to dk gr, finely silty to very silty, with zones shaly siltstn. In upper 3' zone carb irreg. argill ss, silt ss and blk finely silty sh. Sample ① Lower 10' Sample ② Upper 5'
D.	1.6	Siltstone, hard, irreg. massive ledge, Fe stained, hard carb frags.
E.	3.8	Shale, hard, blue fissile, very finely silty, with 0.4 bed siltstone at top as in D. Sample ③
F.	14.0	Shale, dk gr to bl, finely silty to

.5

53.3
2.6
4.9
14.3

75.1

silty, in lower 7.9 silty with zones & beds shaly silt & argill silt laminae. Silty zones have Fed. (Sample 4) = lower 7'
(Sample 5) = upper 7'

G. 2.6 Shaly siltstone with thin interbeds finely laminated silt (local x-lam) possibly very fine ss. Breaks to thin platy frags & chips.

H. 4.9 Shale, gray silty some gray shaly silt layers.
(Sample 6)

I 19.3 Shale, gray silty with thin interbeds of silt, gray, mostly do not crop, but in upper 5' a few silt beds, hard, resistant Fossils in this interval.
(Sample 7, Inoceramus sp. lower 10'± (Sample 8, upper 10'±) & A-816 Meg. fossils

J. 20.2 Interbedded silty shale and platy, thin bedded, 1cm to 4cm x 1cm siltstone, siltstone increases upward at expense of silty shale. locally crops in thin, platy ledges. some calc. concs in upper part. Fossils, sparse, - fragments
(Sample 9.)

K 16.3 Fine gr. laminated (x-lam) finess and siltstone with partings

Unit K

30

and thin beds of silty shale, which break up siltstone into platy ledges or indentations in massive ledge. Both silt & sh show concretions. Upper 3' shale more pleistid and siltst in less prominent ledges.

L.	8.2	Argillaceous siltstone, soft, gray, irreg. bedded, with zones of silty dk gray calc. concretions (Sample in part)
M	3.4	Siltstone, argill to non-argill, hard blocky fract, in thin beds some brown weath.
N	0.2	Bentonitic clay greenish gray (Sample in part)
O	2.0	Argillaceous siltstone, shale, silty in basal part. (Sample in part)
P	1.9	Siltstone, ledgy, as in M. above with local Fe brown weath calc. concretions
Q	7.6	Siltstone, argillaceous, blocky to irreg. fract. some carb fragments, local lenses of ledgy siltst in lower part. Scattered thin beds in upper 4'. Several calc. concretions, brn weath. in lower foot.
R.	40.0	Siltstone, massive, argill. in lower 20.0, becoming hard & tough 20-30 upper 10' chiefly fine silty ss. that is resistant enough to [illegible]

42

		Form ledge; Whole is crumbly irreg. bedding visible at all. Upper 20' has argill. meter thick interlayerings, & laminae, latter irregular as if disturbed while soft. Carb. mat. in plugs & flecks throughout
S.	8.0	Siltstone and fine ss as below but laterally gets more argillaceous and tends to lie in slope. Locally upper 2' a ledge separated from the below by break of more argill siltstn.
T.	9.1	Shale bl. to dk gray (up) finely silty to silty upward. A few scattered thin beds silt & fine ss below, more numerous in upper 3' (Sample 11)
U.	14.5	Fine gr. ss and. siltst. Thin to med. to laminated, + X lam. interbedded with shaly siltstone and mudstone silty shales. Unit is similar to K. Slightly calc, with some limy dense beds esp. and here. One heavy ledge in middle part and thin ones above + below. Less shaly.
V.	9.6	Argillaceous siltstone, gray, blocky fracture, a few

prob. rate

43

fairly hard beds, one at 0.6 ft. top.

W	0.2	Lower 0.1 is waxy gray bentonitic clay, upper 0.1 black shale.
X.	5.3	Argillaceous siltstone, blocky fracture, hard. Upper 0.6 local ledge
Y.	0.3	Lower 0.2 is waxy gray bentonitic clay, upper is dk gray shale.
Z.	2.1	Argillaceous siltstone as in X
AA.	2.4	Siltstone and fine sandstone in thin beds, silt is argillaceous, some limy beds and Fe brown concs. of limey matter. Fossil. pelecypod Fe brown ledge.
BB.	23.0	Argillaceous siltstone grading upward into fine argill SS. Lower 15' very argill, with minor shale splotches. Upper 8 sandy beds begin to appear. This and CC above are similar to unit R. BB grades into ledge of CC
CC	18.9	Sandstone and siltstone, fine argill, massive, irreg beds of hard argill. dk pinys. & czrb trays which form crumbly blocky weather. ledge. Upper

Note — At top section CC is thin bedded with light brown [illegible]

streaks stick-u bent-like clay- total thickness this zone less than 0.1.

DD. 0.9 Argillaceous siltstone + silty claystone. Dk gray. Sec. about [illegible]

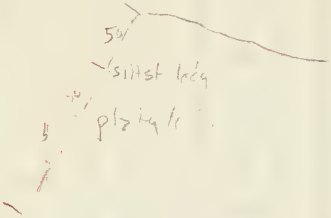
EE 7.1 Siltstone, grey, argill., irreg. carb fragments, sandy in lower 1.0, top is fine ss zone argill. [illegible] pyr. inclusions.

FF 6.0 to 10.0 Platy, irreg bedded, s[illegible] and silty ss. grey, with carb fragments, locally siltst + shaly ss. Inclusions laterally in thickness across to channel base of GG.

GG. 17.0 Sandstone, fine grained (local medium) quartzitic. x-bedded. Plentiful tabular cavities that once held plant fragments, clay pellets, + fine fish vert present.

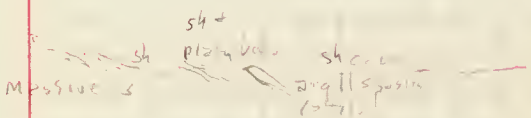
Total thickness 308.3

60
10-15


SW
siltst lacy
plz ing ls

N 10° E 22°

A. A'


SW
SW
plz ng vol
SW
Massive s
argill spastic

1

N 3

1.2
3.4
.8
4.8 .9

Lyon Road Section #1 [illegible] -1B-163

Partial section, based on [illegible] slab in bottom of draw just N [illegible] tree.

A	41.2	Argillaceous siltstone, dark gray thin irreg-bedded, loc X bed, slabby-weathering few shaly breaks, slightly calcareous
B	3.9	Obscured, include shaly siltstone, silty shale and some platy siltstone in [illegible]
C	1.0	Ledge calc argill siltstone, thin beds local slaty cong. Fe, brn weath.
D	13.8	Argillaceous siltstone, lower 3.5 calc, as in A, above this more shaly, crumbly on slope with harder bed, calc brn weath 7.0 [illegible] base and at top, each 1.0.
E	46.0	Obscured. In basal 10 ft above [illegible] argill ss [illegible] shaly [illegible] 25' 6' is sandy- [illegible] fine, [illegible] argill ss with [illegible] base to conch weath fine [illegible] [illegible] base is [illegible] gray to dk gray

Base of [illegible] on [illegible] bed on top silty [illegible] 3.0 [illegible], with argill [illegible] slight betw, is [illegible]

47

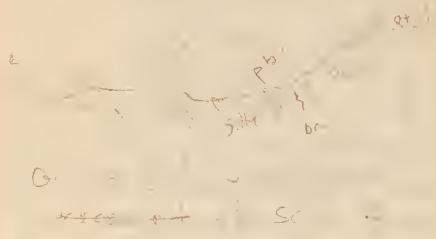
F.	31.5.	lower 15' obscured - some. argill siltstn wash. Upper part, at least 15', is br-gr weath. qtzt., fine gr. [N 31° E, N 25° E]

Lyons Exposures

Road Section # 2.

Partial section from base quartzite down.

A		Quartzite.
B	0.5	Sandy argill. siltstone,
C	0.9	Argillaceous fine gr silty ss, somewhat ledgy, locally elastic
D.	1.4	Shale, grading upward into argill, siltstn. gray.
E	1.7	Fine gr ss, carb inclusions, ledge, local argill.
F	1.5'	Shale dk gray, with 0.1 bentonite at base (Sample 1) TA-82
G.	2.7	Siltstone and fine ss, argill. weath. light gray to brown blocky fracture, plant & carb root like inclusions. Grades downward to next interval.
H.	7.3	Dk gray, argill. siltstone, crumbly and silty claystone - softer in lower 3'±.
I	39.8	Si-ss. [illegible]



Lith. Thompson Bros.

Cut for E tunnel entry. Note Lyle coal seam in west face of reduction - Subsidiary station at its base - Lyle coal [illegible]

See also Notebook 8, p. 28 et seq.

Lyons Road, Section 3

Pre-[illegible] - Pre-[illegible] Ledge and presumably [illegible] Group of outcrop. Double [illegible] top of this.

A.	1.2	Quartzite, [illegible] weathers light brown to red brown
B.	0.7	Siltstone, green [illegible]
C.	0.6	Bentonite
D.	0.5	Silty green clay stone, some [illegible]
E	0.4	Siltstone. Hard bed forms [illegible]
F	1.5	Sandstone, upper 1.0 [illegible] silty, lower [illegible] white [illegible]
G.	0.2	Siltstone [illegible]
H.	2.4	Shale, [illegible]
I	0.3	Bentonite (Sample 2)
J	0.2	Dk gr Siltstone [illegible]
K	1.2	Sandstone - silty, [illegible]
L.	1.3	Shale, black, [illegible]
M.	4.2	Sandstone, [illegible]

Gp. Bed

Mem 1st Ke.

[illegible]

51

I.	7,4	Silt, dk. grey, irreg. struct.
O.	8,0	
F.	11,7	

AIN-51-38

(5) Attitude on upper ss N. 18 W. 48°E

(6)+(6B) Abandoned headings.

(7) Open heading

(8) Pocket of clay of local extent mined here

(9) [illegible]

[illegible]

Section from base measured water level to top [illegible]

19.4 – Zone of thin clay beds, more highly variable & consist. of interb. dk gray to blish, silty sh, and beds ~~argill~~ fine gr, loc. argill. brn. weath. ss. Lent. ss up to 4'± from 0.2.

Main bed

3.3 Silty dk gray clay ~~with~~ some

argillaceous siltstone, local Fe stain in silty zones

2.4 Brittle dk grey finely silty fissile shale with thin interbed siltstone

0.4 Ironstone zone.

3.2 Dk grey shale, semi pl. very finely silty in upper 1' + few thin laminae siltstone. Differs from clay below in somewhat more splintery-shaly fracture, less soapy feel.

6.6 Dk grey semi plastic clay

0.2 Platey argill siltstone finer ss

0.3 Dk grey silty sh-shaly siltst

0.2 Bentonitic clay

2.3 Sandstone, massive bed fine gr. ripple marked upper surface

Lapse ss.

0.6 Argillaceous siltstone, dk grey, grad. into bed above, hard, part of ledge

3.8 Shaly dk grey siltstone + silty sh. 0.2 rusty zone at base with tough bent like seams.

L. split

0.2 Sandstone, fine and argill. siltstone

1.2 Argill. siltstone, massive fine ss dk. grey. vaguely-gradues into ↓

1.3 Dk grey silty shale Top 1st ss.

On slope to west and so obscured looks to be as it is in plain in lower part

(10) Good outcrop Lynn ss + cgl here.

Ralston - lower split has thin bentonite at top + base.

Dorrell, Carter V., 1934 M.S. Thesis, U. of C.

378.788 B, D.737a.

The use of mechanical analysis in the correlation of Cretaceous bentonites and metabentonites in eastern Colorado.

Discusses use of bentonites in correlation, describes pipette method of mechanical analysis. Among literature cited on methods of correlation etc following should be consulted

1. Ross & Shannon: The minerals of bentonite and related clays and their physical properties. Jour. Am. Ceram. Soc. Vol. 9, 1926, pp 77-96

2. Whitcomb, L.: Correlation by Ordovician bentonites. Jour. Geol. vol. 40, no. 6, 1932 p 522

3. Warren, J.A. Effect of Salt water on bentonite. Min & Met. Vol. 7 1926, p349

4. Krumbein: Mechanical analysis of fine grained sediments. Jour. Sed. Pet. vol 2, no 3 1932

5. Coward H.F. "Sedimentation of bentonite" Jour. Chem. Soc. vol. 125, 1924, 1470

57.

Paper has good bibliog. Experiments are on Pierre bentonites only. Good survey giving general aspects of bentonite.

Hayes, John. R. 1950 PhD thesis U of Colo
378.788 A, H 3273 c.
Cretaceous stratigraphy of eastern Colorado

Good paper. Analyses subsurface Dakota – along with Goldstein's work this is a must reference before writing it up.

Chief contribution is evidence of northward intertonguing of Benton & Dakota.

Also that sharp Morrison contact in many electrologs. – check see how SS porous vs SS with fines reacts – may be key to it.

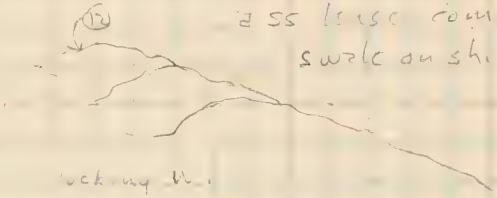
Some ref.

Lovington, C.S. Greenwood oil field Weld Co. Colo. [Stratig. type Oil fields. – A A P G 1941, pp. 19-43
Con the Greenwood tongue.
Rankin C.H., Jr. – A.A.P.G vol 17, no 4 1933 – well sections in NE. Colo

AIN 50 44.

(11) Transition beds top Deltota (N°E, 51E)

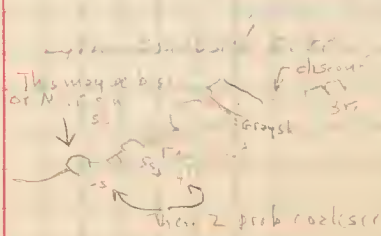
(12) Outcrop of clay bed on Cors... Expl. line. Between here and 11 it appears as though the overlying ss is step-faulted in small breaks. May be just ss base coming into swale on sh. betw. 2 ss.



Clay bed here is 5.2, bentonite @ base. lower split is in but not exposed.

below this is 1st ss. 20'± ... 5' ... and 2' ... a few plates fro..., one with Inoceramus sp. Good leaves near top + possibly with 1st ss. — include variety of dicots.

(13)



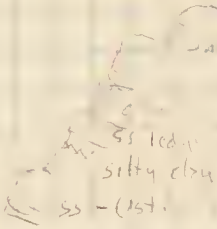
(14) N72°E 48°S

15 N 13W, 33°E on top first massive below transition beds. Just to N is fault, downthrown to S, with about 30 feet throw. Top SS is thick here = 3-

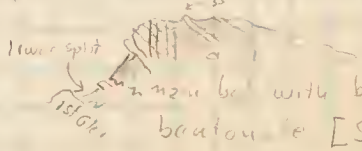
16. N 28 E 61°E on ? possibly 2nd SS.

AIN 51-28

(11) Main bed in here, cut out by channel to N. Sandy clay is in over channel below it & top Dak. To N. float from top Dak obscures everything



(12) Thick shaly section in Dakota here An upper SS on back slope



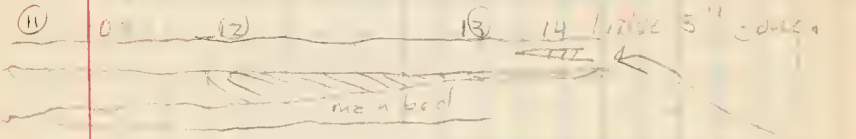
boulders [Sample AIN 51-28

Bed beneath lower Dak clay (13) Sample 1 strike (x bedded) obliquely into base of it.

Lower split persists along with main bed. Is little 3" unless what I'm calling Dakota clay here.

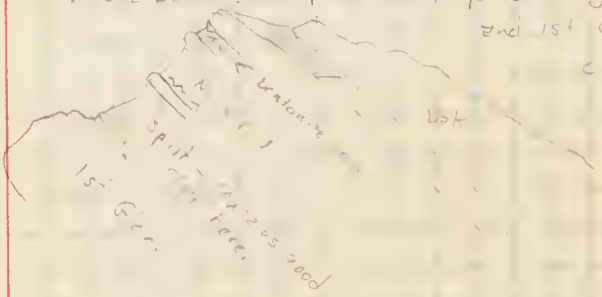
60.

(13) The ledge separating the main. clay bed from the clay I called "Dakota" is 12 feet south to here where it is little more than 1' thick. -- Suspect clays called Dakota are the

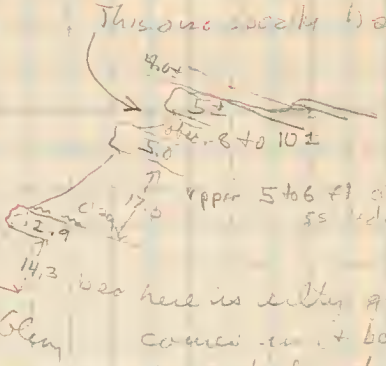


Just in about 5' is ledge of hard ss ledge 4' + comes in (shows on photo) It comes in in middle of sec. Just below Dak. see diagram above. 10 to 8 ft with base of Diatomite on ripple marked surface.

(15) Beds are pushed up in dip slope. Main [illegible] split [illegible] over just to S. and ist Glen to his excl.



16 Approx measurements of clay complex



base here is silty green clay
contains + bentonite
to S. below here (15)

First Clay ss is 15 to 20, poor 2nd ss
zone the 2nd is unoxidized has
reduced upper part - lacks coal

AIN-50-444

(18) ~~Moffett~~ Mine **New Johnson Mine**

In on main clay - at working face
is 4.9 ft 200' + from entry, this
torn roof pinch, then opens to
6.0 + closer to entry
Bentonite-like clay at base is about 0.1 to
0.4 grades into clay. Clay uniform,
tough slickensided laminated - almost looks
varved. Pyrite coating on surface.
one 0.2 zone of [illegible]
clay about 2.2 from base
Foot wall stripped to ripple - N-S
Surface - beautiful exposure.
Samples - Spot of main clay and
Basal 4" (bentonitic?)

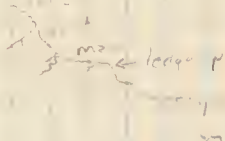
N 12 E
45° W

lamination is due to fine silt — no beds of sand known.

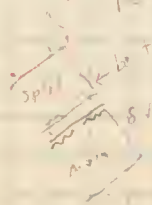
(17) Jackass Mine. N 12° E, 45° W overturned. Main bed, small opening across on N side drew from Moffat mine. bed thins pinched by descending roof rock to N.

AIN 51-28 (small)

(1) In pit. N 15 W, 33° W - below in on slope Dek leaves.
On Dek. N 70 W, 22° W
Both lower split on main bed are in here.



(2) Drift opening - obsn. [illegible] shows opening on Dip 15 47° W N 23 W dr. Top on [illegible] W
ss under main bent and at top of c'l. of lower split.



(3) Railroad cut showing top Devonian. It consists of thin beds alternating with beds of shale. Indication of shaling out of top sandstone to N.

AJN-50-4 small?

N 13° W, 45° W, Light colored shales with [illegible] and some siltstone layers with [illegible] No fossils. May be in Upper Devonian, near contact with [illegible] at site of pit. [illegible] white [illegible] weathered [illegible]

1.2
3.0
1.4
2.1
2.4
2.4
7.8
0.5
0.4
4.1
1.5
2.3
2.7
0.7
0.8
2.3
9.5
5.8
6.4
6.6
16.2
72.0

Magbert Mine section.

from base lowest c. g mined, up.

Footwall with ripple marked surface

A	0.1	Bentonite
B	1.0	Argillaceous siltstone, interbedded laminae of silt.
C	1.7	Clay, silty dk gr to black, with thin laminae siltstone.
	1.3	Interbedded platy to shaly siltstone and silty shale with silt laminae.
	2.5	Clay, blk grey to black with laminae, silty at top.
	6.2	Sandstone, fine grained, cross bedded. Sub rounded quartz grains.
G	1.-	Siltstone, carbonaceous platy to shaly. Laminae.
H	3.-	Clay, black fine silty carbonaceous with distorted laminae. Massive. More silty and laminae at top. Sample ①
	1.0	Black shaly platy to fissile carbonaceous clay. Laminae at top of bed.
J	5.4	Sandstone, fine grained, cross bedded, but thin beds, with laminae.
K	2.7	Clay (normal) dark grey, fissile, some platy, laminae with lighter silts. Sample ②
L	3.1	Sandstone, fine grained, thin bedded, siliceous cement, some clay laminae.

65.

This [illegible] consist
3 [illegible] S [illegible]

2,1 Sandst

3,9 – [illegible] sandst
clay pebs

3,9 – [illegible] silty
lamonat

4,6 – pebble conglom clay (Sample 5)
bentonitic at base
(= X below)

Log 1

M	5.0	Grey silty clay Sample 4
"	4.5	Argillaceous silt with sand ; fine quartz to fine SS upward
	1.3	Clay, [illegible] Sample 3
	1.3	Sandy silty clay and [illegible] locally joins 1.3 below silty bay
~~N~~	~~1.0~~	~~SS silty, clay, pinches, carb wisps~~
Q	0.8	Sandstone, fine gr.
R	ca 7	[illegible] silty sand & [illegible]
S	2.7	Sandstone, fine grained, (½" 0.1 pisolitic clay parting at top)
T	2.2	silty to argillaceous, fine SS, [illegible] cross bedded.
U	1.5	Similar to above with pisolitic clay zone, about 0.3 [illegible] at top and base
V	1.4	Sandstone, fine gr., [illegible] cross bedded.
W	0.4	[illegible] silty gray clay
X	0.5	Bentonitic clay Sample 6
Y	7.5	Silty light colored SS, yellow [illegible] SS with [illegible]
Z	2.4	Carb Clay, silty, brown in lower 1.0 with Carbonaceous [illegible] is carb clay.
A1	2.4	Sandstone, fine gr X-bedded.
B1	2.7	Argillaceous silts & SS grading up to fine SS

CC.	1.4	lignitic clay - very lignitic
DD.	3.0	[illegible] Interbedded interlaminated) & lenticular, lig. siltstone & fine ss & very [illegible], dk. carb. siltst.
EE	1.2	fine ss, [illegible] lenses s=, [illegible]
FF	1.1	Light gray, sl [illegible] ity bed (Probable [illegible] Sample 7 of [illegible]
GG	—	B[illegible] base, [illegible] Sample 8 is lower 1.0

1. Coal is not [illegible]

Strainland Mine —
from Cross cut out.
Sandrock — silty carb mudst

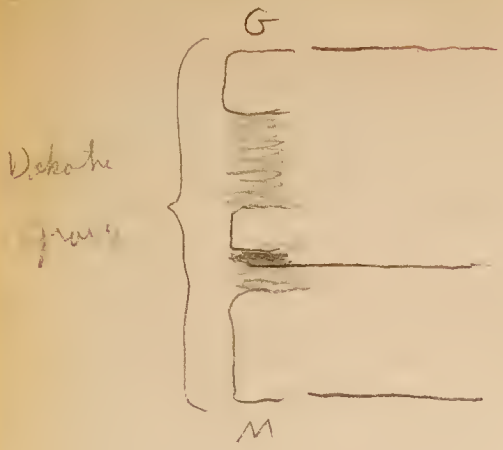
A	6.7	Interbedded silty shale and siltstone, Fe siltstone lg text Dk gray to black silty clay with silt laminae in upper 1.7
B.	0.2	Bentonitic clay Sample 1
C	1.6	Shale dk gray to blk silty carb silt laminae

D.	5.8	Dk grey siltstone, carb fossiliferous some shaly zones near base.
E Kootenay	16.6	Sandstone fine grained cross bedded, vuggy, white, weathers some yellow-orange. Flint stringers above base.
F	10.4	Dark grey to black highly silty carbonaceous clay. (Black slice)
G.	22.7	Sandstone, fine grained, white, yellow stain.
H.	1.6	Interbedded dk siltstone and fine grained micaceous shale.
I	3.0	Black silty shale with thin interbedded siltstone ribbon clay.
J.	1.0	Sandstone, shaly argill.
K.	12-20.0	Main bed. } see sketch section
L.	5.0	Dk grey argill. siltstn and
M.	11.0	Sandstone, fine grained white
N.	1.2	Sh dk grey clay & siltstone
O	1.6	Eucalyptus fine ss with interbedded siltstn.
P.	14.7	Sandstone, fine grained, lower 2 ft with silty shale ptgs.
R.	5.3	Lower .5 silty clay remainder argill siltstn Dk. upper 1.2 platy siltstn & ss with dk ptg.

68.

Cold down here — 34° - 86° at surface

4.8	Sandstone [illegible]
1.0	LB shale, platy siltstone
4.3	S[illegible] even, bedded, shaley at top 1/4 from top.
3.8	S[illegible] grading to [illegible] -2 vugs up.
0.4	Ss
0.2	Bentonite
13.0	T[illegible] siltstone and thin ss dk shale with bentonite 3.5 — from top 5.5 " " 3.0 — base
6.0	Dk grey hard silty shale
1.7	Sandstone, hard fine grained — Dk. grey shale — lower 1' is silty, sandy.


G
M

Neb. 89-235

Jim Devine